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FLOOD INSURANCE STUDY

ORIGINAL

CITY OF NILES, MICHIGAN

BERRIEN AND CASS COUNTIES

JULY 16, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 260040

(23)

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participeting in the National Flood Insurance Program (NFIP) have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	2
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	4
3.2	Hydraulic Analyses	5
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	6
4.1	Floodplain Boundaries	6
4.2	Floodways	7
5.0	INSURANCE APPLICATION	10
6.0	FLOOD INSURANCE RATE MAP	10
7.0	OTHER STUDIES	11
8.0	LOCATION OF DATA	11
9.0	REFERENCES AND BIBLIOGRAPHY	11

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TABLE OF CONTENTS (continued)

Page

FIGURES

Figure 1 - Vicinity Map 3

Figure 2 - Floodway Schematic 10

TABLES

Table 1 - Summary of Discharges 5

Table 2 - Floodway Data 8

EXHIBITS

Flood Profiles

St. Joseph River	Panels	01P-02P
Dowagiac River	Panel	03P
West Tributary	Panels	04P-06P

Flood Insurance Rate Map Index
Flood Insurance Rate Map

Elevation Reference Marks

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FLOOD INSURANCE STUDY

CITY OF NILES,
BERRIEN AND CASS COUNTIES,
MICHIGAN

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Niles, Berrien and Cass Counties, Michigan, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by STS Consultants, Ltd. (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-83-C-1169. This study was completed in August 1985.

1.3 Coordination

Streams requiring detailed study were identified at a meeting held on April 18, 1983, and attended by representatives of the Study Contractor, FEMA, and the City of Niles. Results of the hydrologic analyses were coordinated with the State of Michigan Department of Natural Resources (MDNR), the U.S. Army Corps of Engineers (COE), the City of Niles, and various agencies of Berrien County.

On August 28, 1986, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Niles, Berrien and Cass Counties, Michigan. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the St. Joseph River, the Dowagiac River, and West Tributary was studied in detail within the community.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through August 1990. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Niles.

2.2 Community Description

The City of Niles is located in southwestern Michigan within the Township of Niles. The city is bordered on the north, west, south, and southeast by the unincorporated areas of Berrien County and on the northeast by the unincorporated areas of Cass County. Niles is served by Conrail and U.S. Highways 31 and 33. The 1980 population was reported to be 13,115 (Reference 1).

Lake Michigan has a strong influence on the climate in this area by moderating temperatures throughout most of the year. Spring and early summer temperatures are cooler than would be expected at this latitude, while fall and winter temperatures are milder. Temperature averages range from 69 degrees Fahrenheit (°F) in summer to 28 °F in winter. Annual average precipitation of the region is 35.40 inches, with an average recorded snowfall of 56.0 inches. Approximately 57 percent of the average annual total precipitation falls within the period of May through October (Reference 2).

Land use in the St. Joseph River watershed is primarily agricultural, although the Cities of South Bend and Elkhart, Indiana, are located upstream of Niles on the banks of the St. Joseph River.

2.3 Principal Flood Problems

Flood conditions in the City of Niles are generally caused by an increase in river flows, which are a result of major rainstorm events within the St. Joseph River watershed. The resulting increase in flood elevations has an impact on residential, commercial, and industrial developments that have been constructed in the floodplains adjacent to the rivers in the watershed.

An historical high-water mark for the St. Joseph River was recorded for a flood that occurred in March 1982. This flood was estimated to have a recurrence interval of less than 50 years (Reference 3). Damages caused by the flood event include inundation of over 25 residences, several businesses, the hospital, and the wastewater treatment plant.

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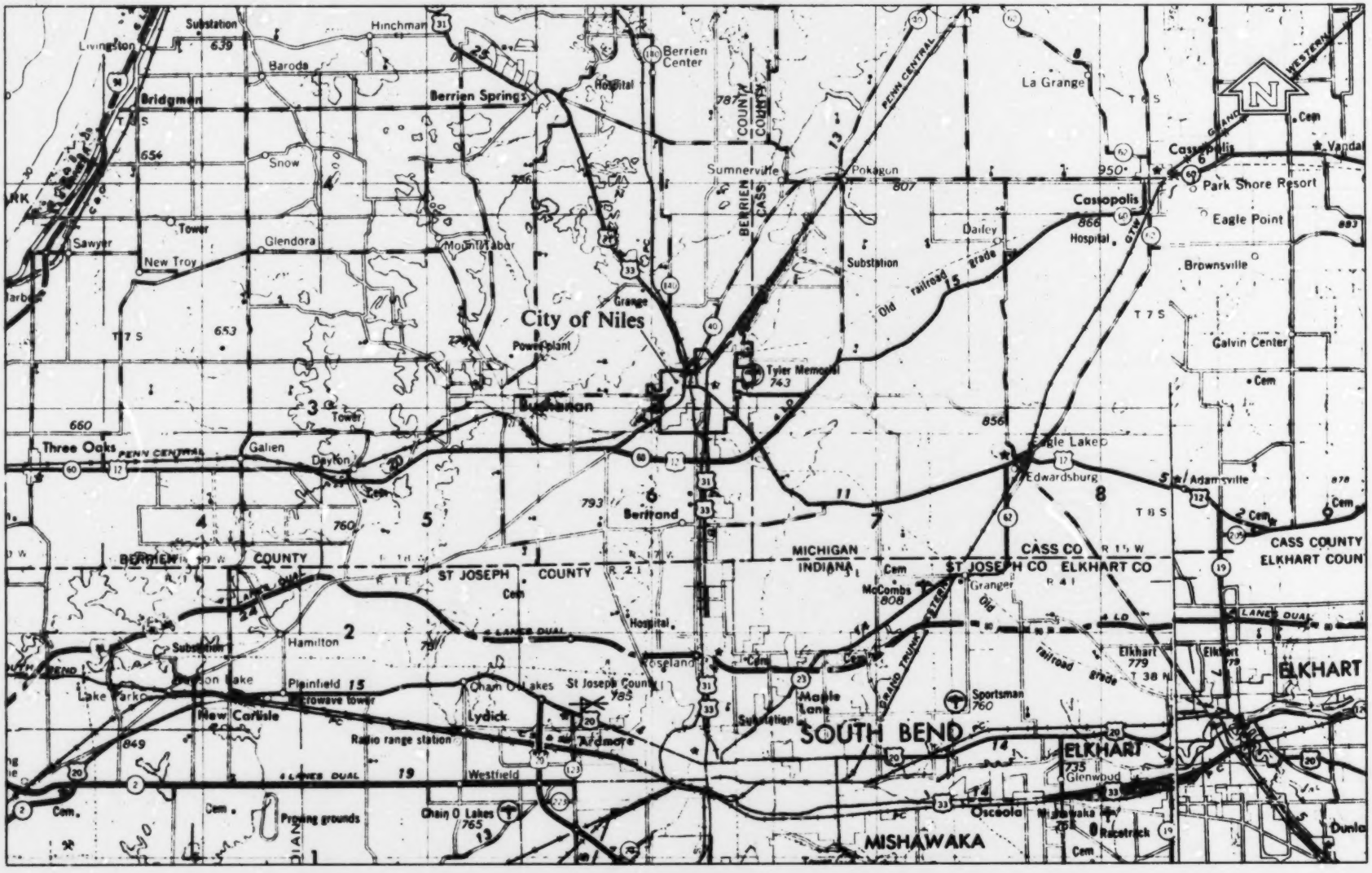

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI

(BERRIEN AND CASS COS.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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2.4 Flood Protection Measures

The French Paper Company Dam is located on the St. Joseph River about 1,600 feet downstream of the confluence of West Tributary. Built in 1914, the dam consists of a 320-foot long concrete spillway with timber flashboards and connecting earth embankments. Crest elevation with the boards up is 653.75 feet and with the boards down is 651.48 feet. The boards are in place from June through December, providing approximately 14 feet of head for power generation at the French Paper Company Powerhouse, located 170 feet downstream from the spillway. Although the primary purpose of the dam appears to be power generation, the structure also serves to attenuate flood peaks through storage in the upstream channel.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

Statistical analyses of streamflow records for the St. Joseph River in Niles were used to establish peak-discharge values. The U.S. Geological Survey maintains a stream gage on the St. Joseph River upstream of the Main Street bridge. This gage has a period of record of over 52 years beginning in October 1930. A log-Pearson Type III analysis was performed by the MDNR with the historic streamflow records to develop frequency-elevation-discharge relationships at the Niles station (Reference 4). These flows were used for the entire reach of the St. Joseph River that was studied.

Flood discharge for the Dowagiac River was estimated based on the transposition of discharge-frequency data from the Summerville stream gage. The drainage area proportion method was used to transpose the discharge-frequency data from the Summerville Gage, located upstream of the study area, to the northern corporate limit of the City of Niles. This

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method uses a proportional ratio of the respective drainage areas (Reference 5). The statistical analysis of 22 years of recorded flows at the Summerville Gage was performed by the MDNR (Reference 4).

Discharge-frequency relationships for West Tributary were developed based on the U.S. Soil Conservation Service TR-55 method, "Urban Hydrology for Small Watersheds" (Reference 6). This method computes the discharge of a watershed by considering the amount of precipitation, infiltration rate in various soil types, antecedent rainfall, vegetation cover, watershed drainage area, impervious surfaces, and the effect of any flood control works in the watershed.

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
ST. JOSEPH RIVER upstream of the confluence of the Dowagiac River	3,666	15,700	20,200	22,000	26,400
DOWAGIAC RIVER at mouth	288	1,270	1,490	1,580	1,800
WEST TRIBUTARY at mouth	2.6	210	340	400	500

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-sections of overbank areas for the backwater analyses of the St. Joseph and Dowagiac Rivers and West Tributary were obtained from aerial photographs at a scale of 1:4800 (Reference 7). The channel sections were obtained by field survey in September 1983. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Insurance Rate Map.

Roughness factors (Manning's "n") used in the hydraulic anlysis were chosen by engineering judgment and based on field observations of the streams and floodplain areas. Roughness values of 0.025 to 0.034 were used for the main channel of the St. Joseph River, while overbank roughness values ranged

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from 0.08 to 0.10 for all floods. Roughness values for the main channel of the Dowagiac River ranged from 0.033 to 0.040, while overbank roughness values ranged from 0.05 to 0.10 for all floods. Roughness factors for the West Tributary ranged from 0.03 to 0.06 for the stream channel, and 0.035 to 0.10 for the overbank areas.

Starting water-surface elevations for the St. Joseph River and West Tributary were calculated using the slope-area method. The starting conditions for the Dowagiac River backwater analysis were established based on the mean annual flood elevation of the St. Joseph River at the confluence of these two streams. This elevation was obtained from a stage-frequency curve developed for the St. Joseph River.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 8). These computations included calibration to match known high-water marks and historical floodflows.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4800 with a contour interval of 2 feet (Reference 7).

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The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. In Michigan though, under Michigan Act 245, Public Acts of 1929, as amended by Act 167, Public Acts of 1968 (Reference 9), encroachment in the floodplain is limited to that which will cause only an insignificant increase in flood heights. Thus, at the recommendation of the Bureau of the Water Management, a floodway having no more than a 0.1-foot surcharge has been delineated for this study. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and the 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
ST. JOSEPH RIVER								
A	1550	315	3217	6.8	644.3	644.3	644.3	0.0
B	3440	561	5281	4.2	646.1	646.1	646.2	0.1
C	4570	258	3996	5.5	646.4	646.4	646.5	0.1
D	5180	374	3596	6.1	646.8	646.8	646.9	0.1
E	5790	315	4328	5.1	647.4	647.4	647.5	0.1
F	6850	322	3195	6.9	647.9	647.9	648.0	0.1
G	7310	324	4680	4.7	648.7	648.7	648.8	0.1
H	7850	296	3716	5.9	648.8	648.8	648.9	0.1
I	8310	301	4431	5.0	649.2	649.2	649.3	0.1
J	8700	331	4831	4.6	649.3	649.3	649.4	0.1
K	9740	622	7460	2.9	649.8	649.8	649.9	0.1
L	10,860	416	6059	3.6	649.9	649.9	649.9	0.0
M	11,560	324	4600	4.8	649.9	649.9	649.9	0.0
N	12,140	320	7163	3.1	659.8	659.8	659.8	0.0
O	12,540	357	5859	3.8	659.8	659.8	659.8	0.0
P	13,180	457	5687	3.9	659.9	659.9	659.9	0.0

[1]FEET ABOVE CONFLUENCE OF DOWAGIAC RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI
(BERRIEN AND CASS COS.)

FLOODWAY DATA

ST. JOSEPH RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
WEST TRIBUTARY								
A	150	37	95	4.2	660.2	658.8[2]	658.8	0.0
B	752	24	128	3.1	673.4	673.4	673.4	0.0
C	1270	20	57	6.9	684.2	684.2	684.2	0.0
D	1380	16	64	6.1	688.6	688.6	688.6	0.0
E	1600	165	160	2.5	691.9	691.9	691.9	0.0
F	1750	85	182	2.2	692.8	692.8	692.8	0.0
G	1880	102	180	2.2	693.8	693.8	693.8	0.0
H	2180	154	255	1.5	695.0	695.0	695.0	0.0
I	2620	158	773	0.5	703.1	703.1	703.1	0.0
J	2770	199	1004	0.4	703.1	703.1	703.1	0.0
K	3230	110	244	1.6	703.1	703.1	703.1	0.0
L	3490	143	216	1.8	703.9	703.9	703.9	0.0

[1]FEET ABOVE MOUTH
[2]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM ST. JOSEPH RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI
(BERRIEN AND CASS COS.)

FLOODWAY DATA

WEST TRIBUTARY

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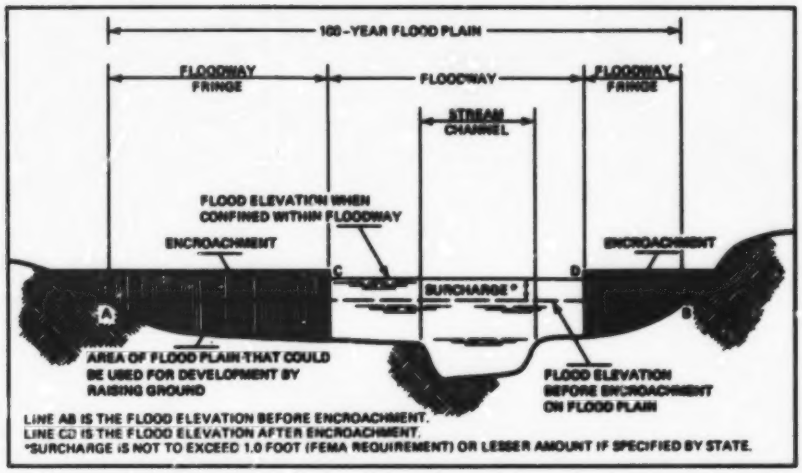
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE *
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

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For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

A Flood Insurance Study is in progress for the Township of Niles (Reference 10) and is in agreement with this study.

Due to its more detailed analysis, this Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for the City of Niles (Reference 11).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 300 South Wacker Drive, Chicago, Illinois 60606.

9.0 REFERENCES AND BIBLIOGRAPHY

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3. Michigan Department of Natural Resources, High Water Mark Survey of 1982 Niles Flood, Lansing, Michigan, April 1983.

4. _____, Statistical Analysis System, log-Pearson Type III Analysis for Stream Gages in Michigan, unpublished, April 1983.

5. U.S. Geological Survey, Michigan Department of Natural Resources, Water Resource Investigations Report 84-4207, Statistical Models for Estimating Flow Characteristics of Michigan Streams, Lansing, Michigan, 1984.

6. U.S. Department of Agriculture, Soil Conservation Service, Technical Release No. 55, Urban Hydrology for Small Watersheds, January 1975.

7. Abrams Aerial Survey Corporation, Aerial Topographic Map of Niles, Michigan, Scale 1:4800, Contour Interval 2 feet, photography, May 1983.

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, April 1984.

9. State of Michigan, Floodplain Control Act of 1968, Act 245, P.A. 1929, as amended by Act 167, P.A. 1968, Michigan Water Resources Commission, Lansing, Michigan, 1968.

10. Federal Emergency Management Agency, Flood Insurance Study, Township of Niles, Berrien County, Michigan, in progress.

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11. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Niles, Berrien and Cass Counties, Michigan, June 1976.

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ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0001	649.24	disc stamped "T 231930" located in south end of concrete pier of Conrail bridge over the St. Joseph River
2	0003	654.19	top of northwest bolt of frost flange on hydrant located about 350 feet northeast of intersection of St. Joseph Avenue and French Street
3	0003	700.38	top of hydrant located at north corner of intersection of Topinabee Street and Wesaw Road

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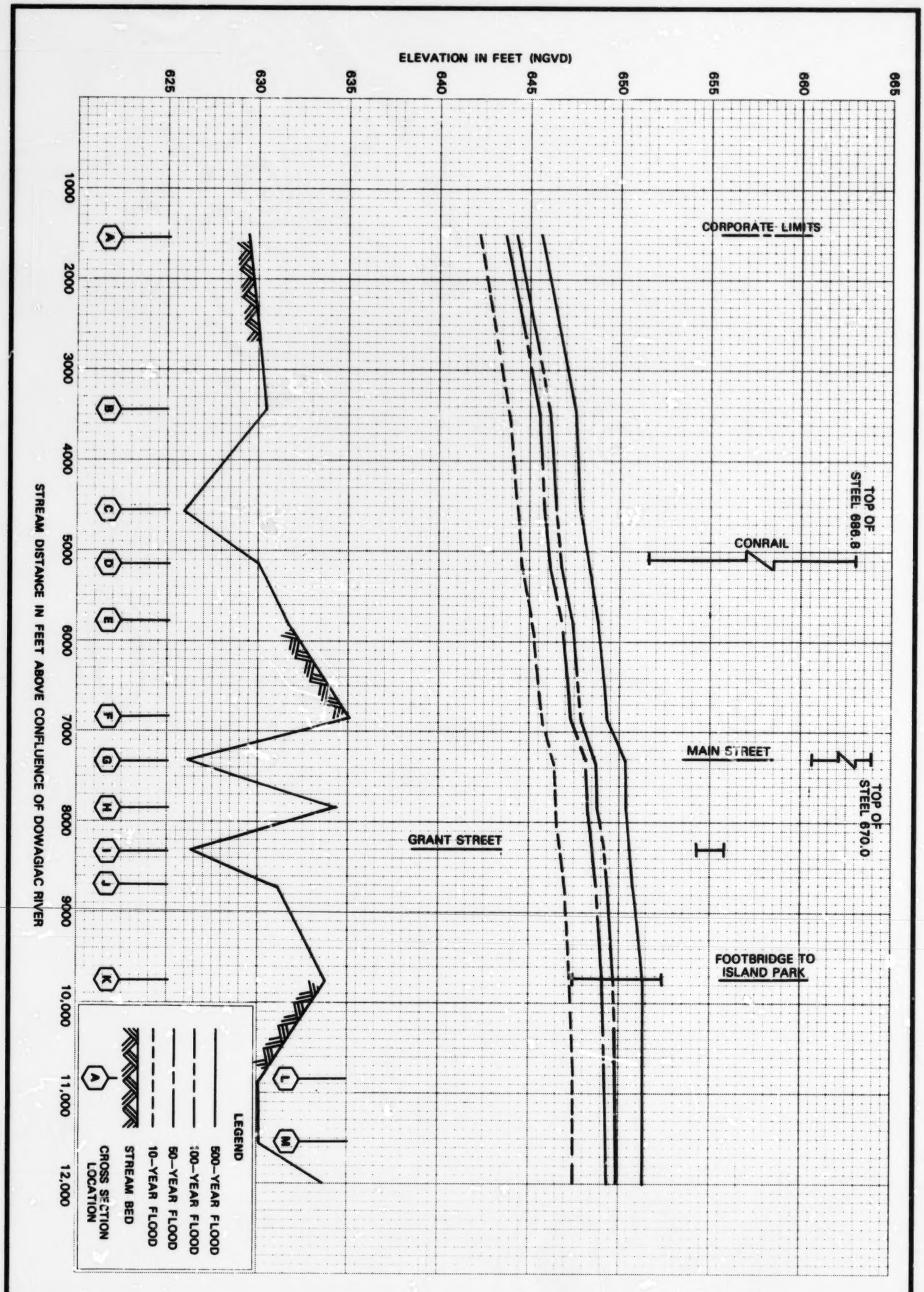

01P	FEDERAL EMERGENCY MANAGEMENT AGENCY **CITY OF NILES, MI** (BERRIEN AND CASS COS)	**FLOOD PROFILES** **ST. JOSEPH RIVER**

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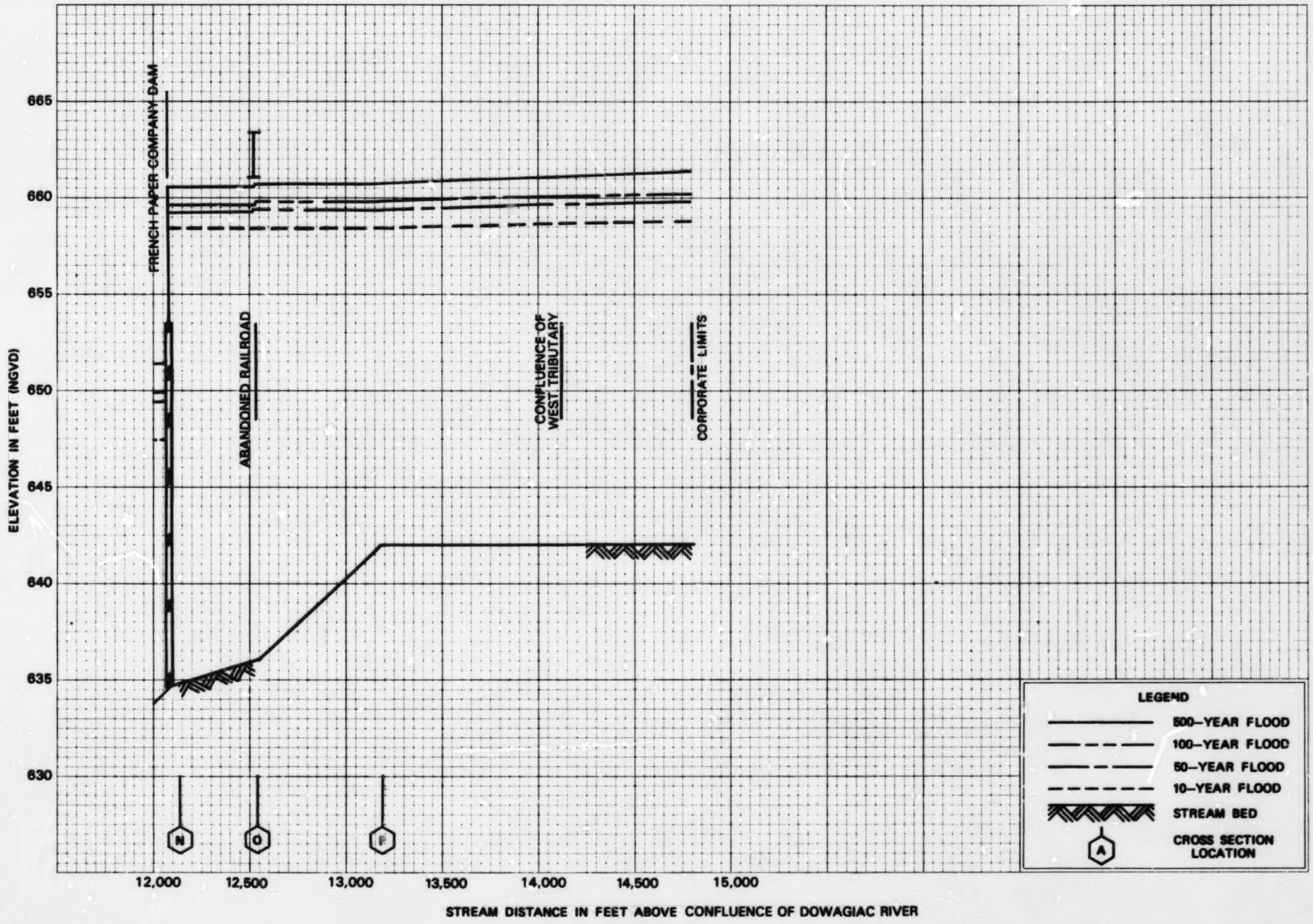

FLOOD PROFILES

ST. JOSEPH RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI

(BERRIEN AND CASS COS)

02P

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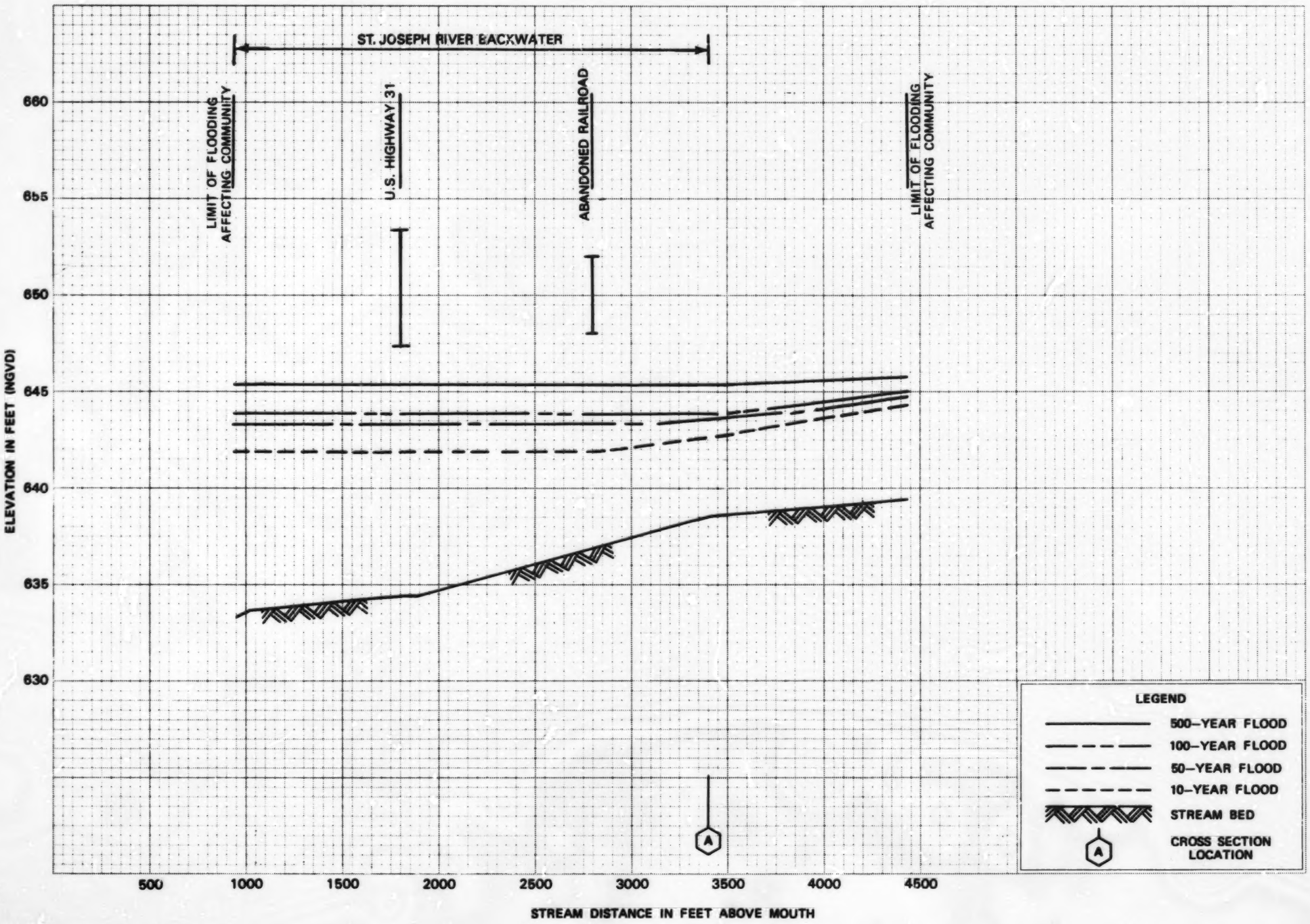

FLOOD PROFILES

DOWAGIAC RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI

(BERRIEN AND CASS COS)

03P

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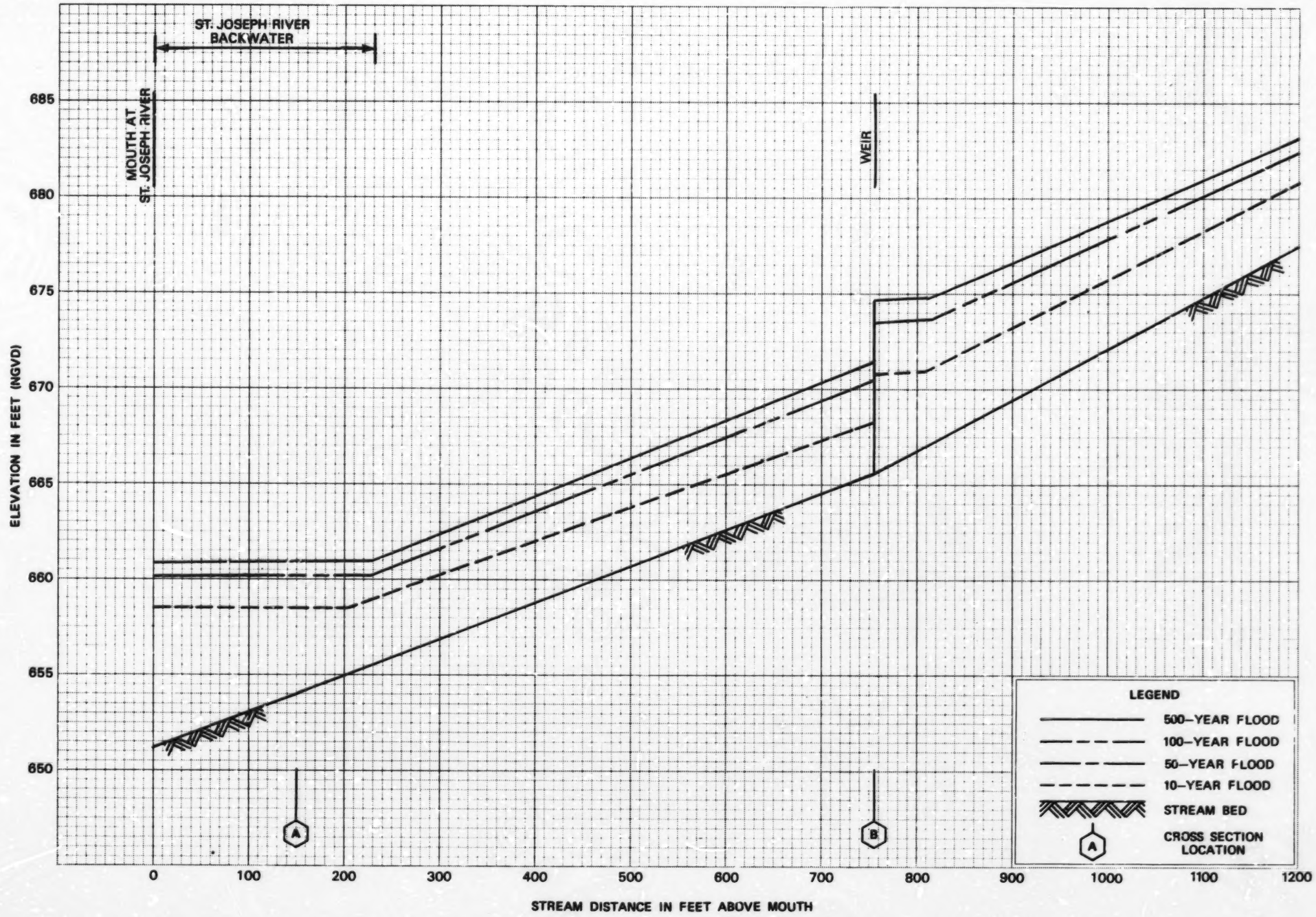

FLOOD PROFILES

WEST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI

(BERRIEN AND CASS COS)

04P

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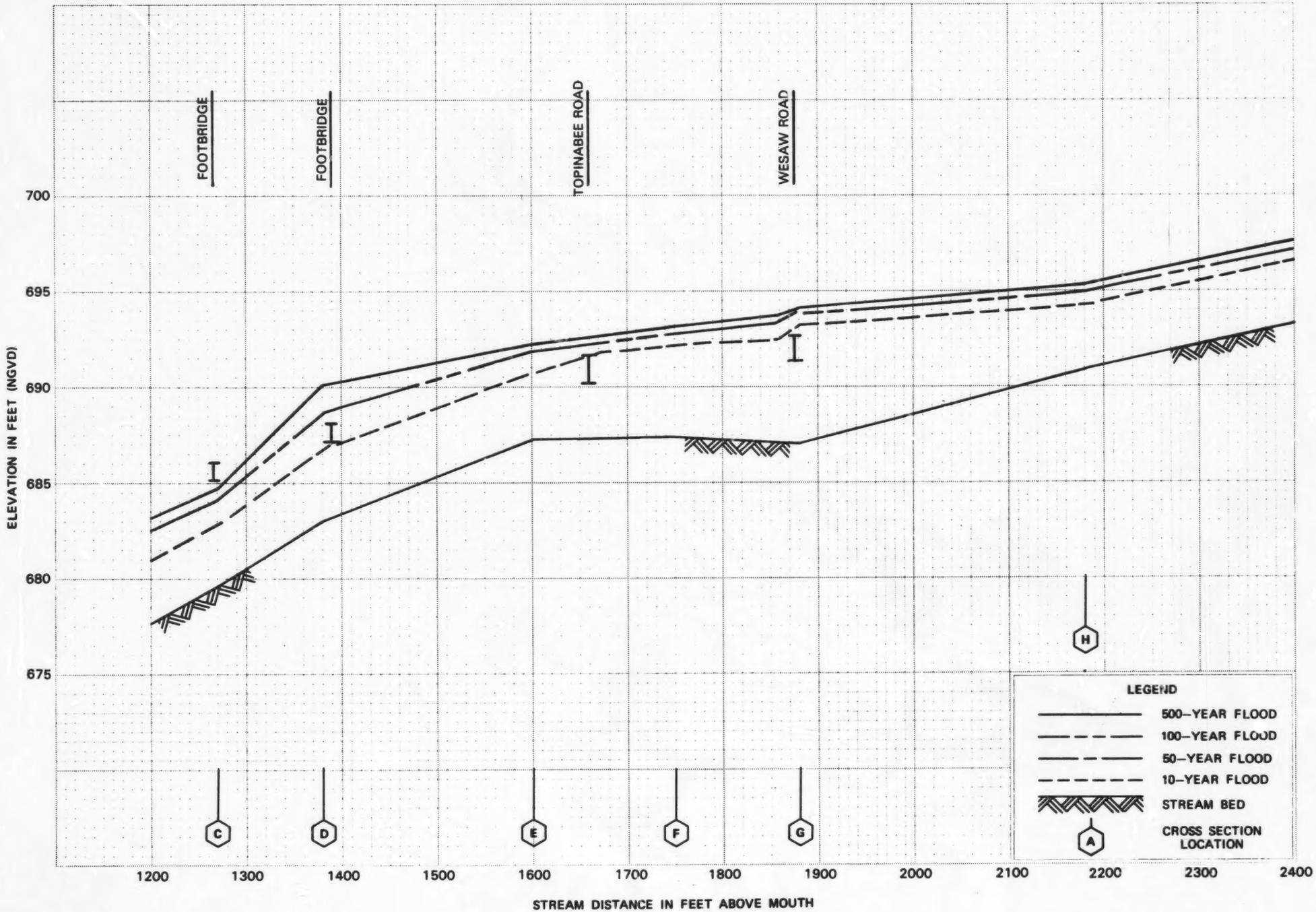

FLOOD PROFILES

WEST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NILES, MI
(BERRIEN AND CASS COS.)

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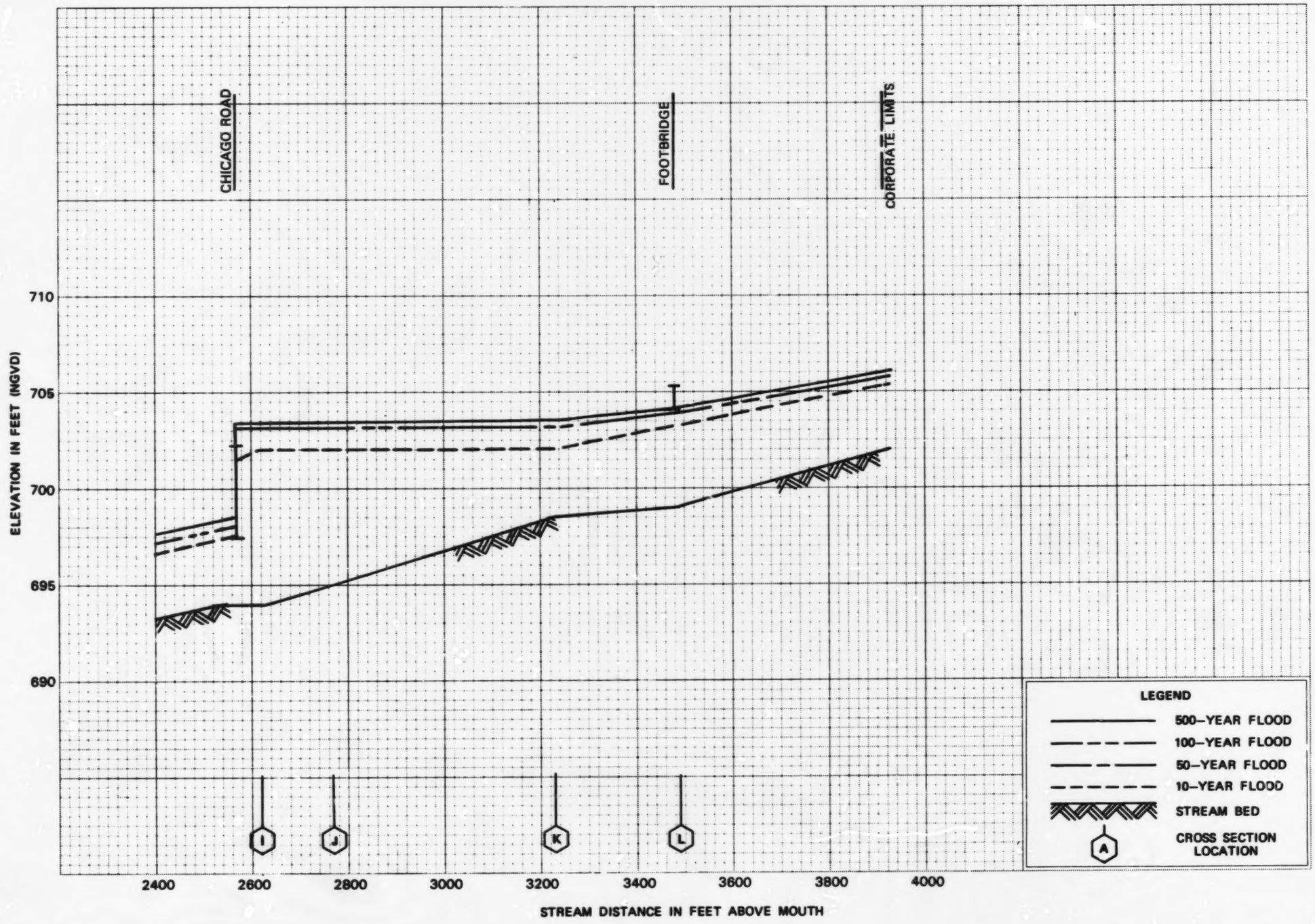

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